CONFIDENTIAL

1 July 1953

MEMORANDUM FOR: TSS/POD

ATTENTION: [redacted] 25X1

SUBJECT: Progress Report on Temperature Testing of Clockwork.

1. The following conclusions are those which can be safely made from the data presented to us:

a. At 70° and at higher temperatures (120° - 154°), there is too much variation among watches to distinguish between the oils.

b. From 0° to -30°, best performance is obtained with no oil or with Myvolube A oil. Next best is Gulf Special Instrument Oil.

c. At -40°, Myvolube A oil is the only satisfactory lubricant. Data indicates it is better than using no oil.

d. Data indicates that watches run slower at room temperature if they have been previously heated to the 150° range.

e. The biggest barrier to making positive conclusions about the difference between oils is the wide variation among the watches. Some watches run slow at low temperatures regardless of the lubricant, whereas others do not seem to lose time at low temperatures for different lubricants.

2. In order to correct for this last conclusion, it is suggested that if any further testing be done, better control could be obtained by trying the different oils on each watch. This would necessitate a thorough cleaning of the watches between application of different lubricants. It would also be helpful if the test with temperature were made in some random fashion.

3. The data

data ?

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3. The data indicates that before any watches be used operationally, that it would be wise to test them at low temperatures beforehand. One can then select those watches which function best under extreme conditions.

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TSS/APD

TSS/APD/CFB:hvm

Distribution:
Addressee - Orig. & 1
APD - 2

APPROVED BY:

[redacted]

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C/TSS/APD

MEMORANDUM

58214-AB
QK-15-529

February 24, 1953 1 25X1

To: [redacted] CONFIDENTIAL Case: Date: Page:

Subject: Progress Report on Temperature Testing of Clockwork

This testing was conducted to determine which of a given group of lubricants would produce the most satisfactory and reliable results over a particular temperature range when used in ordinary pocket watches.

To accomplish the testing, thirty New Haven pocket watches, arranged in five sets of six watches per set, were supplied. Each set was lubricated with a different lubricant except for a "control" set which contained no lubricant. Each watch was numbered and encased in a thin transparent polyethylene envelope. This was intended to seal the watch against moisture and dust particles. Attached to each envelope was a tag stating the number of the watch and the lubricant with which the watch was serviced.

Prior to commencing the testing, the watches were removed from the plastic envelopes by the undersigned for the following reasons:

1. The envelopes were used to approximate ideal conditions. When the watches are placed in actual use, conditions somewhat less than ideal will be in force.

2. During the winding process the ridged rim of the stem cap would chew and tear the thin plastic, thus nullifying any protective qualities the plastic envelopes would have originally afforded.

3. Contrary to expectations, the plastic envelopes were not airtight. The air inside the envelopes could be squeezed out and the envelopes set aside for a few minutes, at the end of which time an examination of the envelopes showed that they again contained air, evidently "inhaled" from the outside.

4. The tests were all to be conducted in cabinets in which both temperature and humidity could be closely controlled. It was felt that the cabinets could control the moisture and dust content of the atmosphere to a better degree than could the envelopes.

The manner in which the units were tested is as follows:

Each watch was wound, set to the correct time as exhibited by a master clock, hung in an upright position on a panel, and placed in a controlled temperature cabinet. After a 24 hour period had elapsed, the watches were compared with the master clock to determine their respective rates. "Rate" may be defined as the time, in minutes, that each watch varies from the master clock during the 24 hour test period. The rate can obviously be either plus or minus, denoting either a fast watch or a slow one.

From: [redacted] CONFIDENTIAL [redacted] 25X1 25X1

FORM 101

After the rate had been recorded, the watches were again wound, set, and subjected to another 24 hour test. This process was repeated at various temperatures until completion of the testing.

The watches were subjected to three 24 hour tests, with the exception of the first 70° F test which was of only 48 hour duration, at each of the following temperatures: 70°F, 0°F, -20°F, -30°F, -40°F, 70°F, 120°F, 140°F, 154°F and finally again at 70°F. Except for the below freezing temperatures, a relative humidity of approximately 22% was maintained during all tests.

The results of the testing are set forth in Table I, a tabulation of the average rate of each watch for each test temperature. The average rate was arrived at by calculating the arithmetic mean of the three test rates at each temperature.

The number 1's enclosed in parentheses which appear in the temperature columns adjacent to the rates denote that only one temperature test was used to arrive at that particular rate. During the other two tests at that temperature the watch stopped before completion of the tests.

The other figures which appear frequently in the low temperature columns denote the approximate length of time in hours that the watch ran before stopping.

The results indicate that for the extreme temperature range to which a watch might be subjected, either an unlubricated watch or one which had been oiled with Myvolube A Oil would be most satisfactory.

Several things were noted during the progress of the test -

1. Watches wound easily at low temperatures but were stiff and hard to wind at high temperatures.
2. One crystal dropped off during the 120°F test. Nearly all crystals became loose in their retaining rings.
3. Moisture condensation was not evident at any time during testing.
4. Throughout the high temperature testing the watches had a slight oily feel.
5. During the high temperature testing the watch crystals work on a definite yellowish cast.

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TABLE I
Average Rate (+ min. in 24 hrs.)
AT

Lubricant	Watch	70°F	0°F	-20°F	-30°F	-40°F	70°F	120°F	140°F	154°F	70°F
Nye Clock Oil	1	-1	-3	-31	-47	7 hrs.	-1	-2	-2	-3	-2
	2	-2	-14(1)	-58	-79	11 "	-3	-6	-9	-12(1)	-8
	3	OT	+3	-50	19 hrs.	1 "	+1	-1	-1	-1	+1
	4	-1	-8	-68(1)	-82(1)	1 "	OT	-1	-1	-1	-1
	5	+2(1)	+1	-7	-10	-25	OT	OT	OT	-1	-1
	6	-3	+2	-23	-32	21 hrs.	-2	-3	-3	-4	-3
Myvolube A Oil	9	-2	-2	-7	-7	-8	-2	-4	-6	-6(1)	-6 (1)
	10	-1	-13	-66	2 hrs.	1 hr.	-3	-3	-4	-4	-4
	11	OT	+2	+1	+1	-2	+1	-1(1)	-1(1)	-2(1)	-1
	12	OT	+2	+3	+2	-30	19 hrs.	-1	OT	OT(1)	+1
	13	OT	+2	+1	+1	-14	+1	OT	-1	OT(1)	+1
	14	-6	-1(1)	-8	-12	-27	-2	-3	-3	-8	-7
No Oil	17	-4	-8	-7	-11(1)	2 hrs.	-6	-9	-10	-8	-23
	18	+1	+4	-3	-5	-6	+3	+2	+2	+3	+4
	19	-2	-1	-15	-38	1 hr.	-2	-3	-3	-3	-4
	20	-2	-1	-9	-27	5 hrs.	-2	-3	-3	-3	-2
	21	OT	+1	-3	-6	-2	+2	+2	+2	+3	+1
	22	-1	+1(1)	-11	+1	-4	+1	+1	-1	+1	+1
Micro-bearing Oil	25	-2	-13	-55	1 hr.	1 hr.	OT	OT	-1	-2	-1
	26	-1	-3	-11	-88	2 hrs.	OT	-1	-2	-3	-1
	27	+1	-2	-18	-135(1)	2 hrs.	+1	OT	-2	-2	OT
	28	-4	-11	-36	8 hrs.	1 hr.	-4	-3	-3	-6	-7
	29	-12	-19	-43	-21(1)	1/4 hr.	-13	-13	-11	-12	-13
	30	-3	-12	-33	14 hrs.	1/2 hr.	-3	-4	-4	-7	-4
Special Instrument Gulf Oil	33	-4(1)	-7	-16	-47	9 hrs.	-4	-6	-4	-5	-6
	34	-1	+1	-2	-27	18 hrs.	OT	-1	-1	-2	-1
	35	-2	-15	-29	-66	15 hrs.	-10	-11	-16	-15	-26
	36	-2	-2	-3	-50	1 hr.	-3	-3	-3	-3	-3
	37	-2	-3	23 hrs.	22 hrs.	1/4 hr.	-2	-2	-1	-1	-2
	38	-3	-1	-8	-30	9 hrs.	-3	-7	-7	-8	-6

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Rate (in min i 24hrs)

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Watch	70°F		0°F			−20°F			−30°F			−40°F			
1	-2	-1	-2	-4	-3	-38	-29	-27	-48	-44	-48	—	—	—	
2	-3	-1	-14			—	-59	-56	-84	-73	—	—	—	—	
3	-1	OT	+3	+2	+3	-76	-37	-36	—	—	-195	—	—	—	A
4	-2	-1	-7		-9	—	-68	—	-82	—	—	—	—	—	
5	+2		+3	+1	OT	-8	-6	-6	-5	-14	-10	-25	-25	-24	
6	-3	-4	+3		+2	-30	-23	-15	-34	-33	-30	—	—	—	
9	-3	-1		-2	-3	-6	-7	-7	-7	-7	-8	-8	-9	-8	
10	-1	-1	-16		-11	-73	-66	-58	—	—	—	—	—	—	
11	-1	+1	+1	+2	+2	+1	OT	+1	OT	+1	+1	-2	-2	-1	B
12	-1	OT	+2	+3	+2	+3	+2	+4	+2	+1	+2	-28	-31	-31	
13	-1	OT	+2	+2	+3	+1	+1	+2	+1	+1	OT	-14	-17	-11	
14	-8	-5			-1	-9	-8	-6	-12	-12	-13	-27	-28	-27	
17	-6	-8	-10	-9	-6	-10	-6	-5	-11	—	—	-20	—	—	
18	+1	+1	+5	+2	+6	-1	-5	-2	-5	-4	-5	-9	-5	-5	
19	-3	-2	-1	-2	-1	-18	-13	-15	-43	-24	-48	—	—	—	C
20	-2	-2	-2	-1	-1	-11	-9	-7	-27	-26	-29	—		—	
21	-1	OT	+1	+1	+2	-2	-5	-3	—	-8	-5	-4		+1	
22	-2	-1			+1	-9	-11	-12	+3	-2	+1	-8		+1	
25	-3	-3	-16	-12	-10	-65	-52	-49	—	—	—	—			
26	-1	-1	-2	-4	-3	-10	-12	-10	-92	-84	—	—			
27	+1	+1	-2	-2	-3	-24	-15	-15	-135	—	—	—			D
28	-5	-4	-14		-8	-49	-24	-36	—	—	—	—			
29	-12	-13	-16	-21	-22	-56	-17	-56	-21	—	—	—			
30	-3	-3	-11	-15	-11	-39	-29	-32	—	-280	—	—			
33		-4	-6	-8	-6	-18	-15	-15	-47	-49	-46	-210			
34	-1	-1	+1	+2	+1	-2	-2	-1	-28	-28	-25	—			
35	-2	-2	-15	-15	-15	-33	-28	-25	-69	-66	-63	—			E
36	-2	-2	-2	-3	-2	-1	-6	-2	-90	-26	-33	—			
37	-2	-2	-6	-3	-1	—	—	—	—	—	—	—			
38	-3		-2	-1	-1	-10	-7	-6	-28	-31	-30	—			

Stock # 3291

RATE (± min in 24 hrs)

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Watch	70°F t=1.08			120°F t=1.9			140°F t=3.1			156°F t=2.1			70°F t=2.3			
1	-1	-2	-1	-2	-2	-1	-2	-2	-2	-2	-3	-5	-2	-3	-2	
2	-2	-3	-3	-5	-8	—	-7	-9	-12	-12	—	—	-6	-8	-9	
3	+1	+1	+1	OT	-1	-1	-1	-1	-1	-1	-1	-1	+1	OT	+1	
4	OT	OT	OT	-1	-1	-2	-1	-1	-1	-1	-1	-1	+1	-1	OT	
5	+1	OT	OT	OT	-2	+1	+1	OT	—	+1	-2	-2	-3	-1	OT	
6	-2	-3	-2 16	-3	-2	-3 39	-3	-3	-3 48	-3	-5	— 38	-4	-3	-3 42	
9	-2	-2	-3	—	-4	-4	-5	—	-6	-6	—	—	-6	—	—	
10	-3	-2	-3	-3	-3	-3	-3	-4	-5	-4	-4	-5	-4	-4	-4	
11	+1	+1	—	—	-1	—	—	-1	—	-2	—	—	-2	-1	OT	
12	—	t=1.3	—	-1	t=2.2 —	-1	OT	t=2.4 OT	OT	—	t=4.2 OT	—	t=2.6	+1	+1	
13	OT	+1	+1	—	OT	-1	-1	OT	-2	-1	OT	—	+1	OT	-7	+1
14	-2	-2	-3 18	-3	-2	-3 29	-2	-2	-5 36	-7	-8	-10 47	—	-7	-2 32	-7
17	-7	-6	-4	-7	-12	-8	-13	-9	-8	-7	-8	-10	-17	-24	+5	-27
18	+2	+5	+3	+2	+2	+3	+2	+2	+3	+4	+2	+4	—	+4	-3	+5
19	-1	-2 t=.02	-3	-3	-3	—	-3	-3	-4	-4	+1	-6	-6	-3	-2	-3
20	-2	-2	-2	-3	-3 t=1.8	-3	-3	t=2.3 -3	-4	-5	t=1.4 OT	-5	-3	t=4.2 -2	+1	-2
21	+3	+1	+2	+3	+2	+1	+1	+2	+2	+3	+3	+2	+2	+1	+2	+1
22	+3	OT	+1 9	+3	OT	OT 27	OT	-3	-1 42	OT	+2	OT 26	+1	+1 46	-1	+2
25	+1	-1	-1	+1	OT	OT	-1	OT	-1	-3	-1	-1	OT	-2	-1	-1
26	OT	OT	OT	-2	-1	-1	-2	-2	-2	-3	-2	-3	-1	-1	OT	-1
27	+2	+1 t=3.0	+1	OT	OT t=3.4	OT	-1	-2	-2	-1	-2	-2	OT	OT	-2	OT
28	-4	-3	-4	-3	-2	-3	-3	-3	-4	-5	-5 t=5.0	-8	-7	-7	-14	-6
29	-13	-13	-12	-13	-12	-13	-11	t=3.2 -12	-11	-11	-11	-14	-12	t=4.5 -14	-8	-14
30	-2	-3	-3 55	-4	-4	-4 61	-3	-4	-4 68	-5	-7	-8 97	-5	-5 54	-5	-3
33	-3	-4	-5	-7	-5	-5	-4	-4	-5	-4	-5	-7	-6	-6	OT	-5
34	OT	—	-1	-1	-1	-2	-1	-1	-2	-2	-2	-2	-1	-1	-29	OT
35	-9	-10	-12	-7	-11	-15	-18	-16	-15	-12	-15	-19	-23	-27	-2	-29
36	-3	-3	-2	-3	-3	-3	-3	-4	-3	-3	-3	-3	-4	-2	-3	-2
37	-3	-2 t=4.1	-2	-2	-2 t=4.8	-1	-1	t=5.9 -1	-1	-2	t=6.1 -1	-1	-2	t=7.2 -2		-3
38	-1	-5	-4 69	-6	-8	— 82	-6	-7	-8 00	-8	—	-9 98	-6	-6 84		-6

Where dashes occur, the clock had stopped

Foregoing data taken from Lab book assigned to 55514 AB.

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